

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

*In the Matter of*

Use of Spectrum Bands Above 24 GHz For Mobile Radio Services

GN Docket No. 14-177

Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40.0 GHz Bands

IB Docket No. 15-256

Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services

WT Docket No. 10-112

Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations

IB Docket No. 97-95

**COMMENTS OF ECHOSTAR SATELLITE OPERATING  
CORPORATION AND HUGHES NETWORK SYSTEMS, LLC**

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## SUMMARY

EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC (collectively, “EchoStar”) combine to form the largest commercial operator of geostationary orbit satellites in the United States and the largest satellite broadband provider in North America, serving over one million users. EchoStar has been at the forefront of developing new spectrum bands, including those above 24 GHz, for the delivery of high-throughput broadband satellite services. Accordingly, it has a significant interest in the Commission’s proposals in this proceeding to adopt service rules allowing flexible fixed and mobile uses in additional bands above 24 GHz as part of the Upper Microwave Flexible Use (“UMFU”) service, some of which would be shared with the Fixed-Satellite Service (“FSS”).

Two of the additional bands under consideration by the Commission are of particular interest to FSS operators for use by next-generation satellite systems: 47.2-50.2 GHz (the “47 GHz band”) and 50.4-52.6 GHz (the “50 GHz band”). EchoStar urges the Commission to preserve the co-primary status of FSS and terrestrial Fixed/Mobile services in the 47 GHz band and the lower portion of the 50 GHz band (50.4-51.4 GHz), and adopt spectrum sharing rules that recognize likely deployment scenarios by the different services. For this purpose, EchoStar builds upon the sharing framework jointly proposed by AT&T and EchoStar earlier in this proceeding, which prioritizes UMFU services in urban core areas while establishing a co-primary sharing regime for individually-licensed FSS earth stations and UMFU base stations in all other areas of the country. The upper portion of the 50 MHz band is currently subject to both a petition for rulemaking before the Commission and technical studies being conducted by the International Telecommunication Union (“ITU”), which could affect how this spectrum is

allocated. Accordingly, EchoStar urges the Commission to let those processes play out rather than pre-judge the outcome at this stage.

EchoStar also supports implementing the Commission's existing rules such that satellites using the 37.5-40 GHz band (the "39 GHz band") would be allowed to operate at higher power flux-density ("PFD") levels in order to compensate for atmospheric interference. Radio signals in the 39 GHz band are highly susceptible to "rain fade," which occurs when water droplets in the air scatter or absorb a significant portion of the radio energy as a signal passes through the atmosphere. In recognition of this phenomenon, the Commission has adopted a two-tiered regime under which satellite operators would be allowed to operate at a higher PFD level allowed internationally under the ITU rules of the when necessary to overcome rain-fade conditions and maintain high-quality service for customers. The Commission did not, however, specify the precise conditions under which it would permit such power increases, as that issue was still under study. It is time for the Commission to implement this portion of the rule, which would enable FSS operators to maintain the integrity of satellite communications while posing little (if any) risk of additional interference to terrestrial operations.

Adopting the approach set forth above would help to unlock the potential value of this spectrum for both 5G and FSS operations – and for FSS's role in the future of 5G as well – to the benefit of U.S. customers.

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IB Docket No. 97-95

**COMMENTS OF ECHOSTAR SATELLITE OPERATING  
CORPORATION AND HUGHES NETWORK SYSTEMS, LLC**

EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC

(collectively, “EchoStar”) submit these comments in response to the Commission’s Further Notice of Proposed Rulemaking (the “*Further Notice*”),<sup>1</sup> which (among other things) proposes to adopt service rules allowing flexible fixed and mobile uses in additional bands above 24 GHz as part of the Upper Microwave Flexible Use (“UMFU”) service, and seeks comment on potential

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<sup>1</sup> See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd. 8014 (2016) (“*Further Notice*”).

mechanisms for spectrum sharing among services in these bands. Two of the bands under consideration by the Commission are of particular interest to Fixed-Satellite Service (“FSS”) operators for use by next-generation high-throughput broadband satellite systems: 47.2-50.2 GHz (the “47 GHz band”) and 50.4-52.6 GHz (the “50 GHz band”). With respect to these bands, EchoStar urges the Commission to take the following steps:

- (1) Preserve the co-primary status of FSS and terrestrial Fixed/Mobile services in the 47 GHz band and lower portion of the 50 GHz band, with spectrum sharing rules that build upon the prior proposal of AT&T and EchoStar that prioritizes UMFU in the urban core areas most likely to see dense deployment while establishing coordination rules in other areas where individually-licensed FSS earth stations will not materially affect deployment.
- (2) Because the upper portion of the 50 GHz band is currently subject to a petition for rulemaking domestically and technical studies internationally that could affect the allocations in this band, await the conclusion of those processes before adopting any rules for that spectrum.

In addition, the Commission seeks comment on whether it should allow FSS satellites in the 37.5-40 GHz band (the “39 GHz band”) to operate at higher power flux-density (“PFD”) levels in order to compensate for rain-fade conditions. EchoStar supports implementing the Commission’s existing rule that authorizes space stations to operate in the 39 GHz band at higher PFD levels (consistent with the levels allowed internationally under the rules of the International Telecommunication Union (“ITU”)) when necessary to overcome atmospheric interference. After thirteen years, it is time to put this rule into effect.

## BACKGROUND

EchoStar, a U.S. company, is the largest commercial operator of geostationary orbit (“GSO”) satellites in the United States and the largest satellite broadband provider in North America, serving over one million users. EchoStar’s broadband service supports consumer use, as well as important government, public safety, educational, and health-related activities.<sup>2</sup> EchoStar also provides vital Internet and voice services to communities during natural disasters and emergencies, when terrestrial and wireless networks have failed or are unreliable.<sup>3</sup>

EchoStar has a fleet of twenty-five owned, leased or managed satellites. Its latest broadband satellite, EchoStar XIX, will operate in the Ka-band (including the 28 GHz band) and is scheduled to be launched in December to augment EchoStar’s ability to provide advanced broadband capacity to consumers in the U.S. and throughout the Americas.<sup>4</sup> In addition, EchoStar is currently designing a new satellite capable of delivering over a terabit of capacity per second, which is being planned to operate in several bands at issue in this proceeding. Thus, EchoStar has a significant interest in the rules adopted by the Commission for use and sharing of the bands above 24 GHz by FSS and UMFU systems.

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<sup>2</sup> See, e.g., Hughes Network Systems, LLC, *Eliminating the DIGITAL DIVIDE in our Schools* (Summer 2015), available at <http://www.hughes.com/company/newsletters/summer-2015/eliminating-the-digital-divide-in-our-schools>.

<sup>3</sup> See Press Release, “Hughes Announces Emergency Networking Solutions for Hurricane Season,” (Jun. 8, 2015), available at <http://www.hughes.com/company/newsroom/press-releases/hughes-announces-emergency-network-solutions-for-hurricane-season>.

<sup>4</sup> Further, Hughes recently launched a broadband satellite service in Brazil, and has additionally procured capacity on Telesat’s new Telstar 19 Vantage satellite, scheduled for launch in early 2018, to expand broadband satellite service in Latin America. See Press Release, “Hughes Launches Consumer Satellite Internet Service in Brazil,” (June 29, 2016), available at <http://www.hughes.com/company/newsroom/press-releases/hughes-launches-consumer-satellite-internet-service-in-brazil>; Press Release, “Hughes and Telesat Sign Agreement for High-Throughput Capacity on Telesat’s New Telstar 19 VANTAGE Satellite Covering South America” (Nov. 11, 2015), available at <http://echostar.com/NewsEvents/PressReleases/PressRelease.aspx?prid=31408>.

## DISCUSSION

### **A. The Commission Should Adopt a Co-Primary Sharing Regime for the 47 GHz Band and Lower 50 GHz Band That Capitalizes on the Differing Deployment Scenarios for FSS and UMFU Operations**

Under the U.S. and international allocation tables, the entire 47 GHz band is available for commercial operations in the FSS, Fixed, and Mobile services on a co-primary basis.<sup>5</sup> However, as the *Further Notice* recognized, while there are service rules for satellite operations in this band, there are none for terrestrial operations.<sup>6</sup> The Commission previously designated the 47.2-48.2 GHz segment for wireless service use and the 48.2-50.2 GHz segment for FSS use.<sup>7</sup> However, “the Commission has made it clear that FSS will be permitted in the 47.2-48.2 GHz band.”<sup>8</sup>

Like the spectrum at 28 GHz considered in the first phase of this proceeding, the 47 GHz band is used for uplink transmissions from earth stations to space stations. Accordingly, the Commission has proposed to adopt a sharing framework for individually-licensed earth stations in this band similar to the one adopted for the 28 GHz band.<sup>9</sup> It has also called for comment on alternative frameworks, such as assigning interference protection on a first-come, first-served basis.<sup>10</sup>

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<sup>5</sup> See 47 C.F.R. § 2.106

<sup>6</sup> See *Further Notice*, ¶ 408.

<sup>7</sup> See *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands*, First Report and Order, 13 FCC Rcd. 24649, ¶ 2 (1998).

<sup>8</sup> *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands*, Order on Reconsideration, 15 FCC Rcd. 1766, ¶ 10 (1999).

<sup>9</sup> See *Further Notice*, ¶ 412.

<sup>10</sup> *Id.* ¶ 415.

Although FSS currently enjoys primary designation in two-thirds of the 47 GHz band while terrestrial services have primary designation in one-third, individually-licensed FSS gateway earth stations and UMFU licensees should be given co-primary status throughout the entire 47 GHz band in order to ensure the most efficient use of this spectrum. Because of the very different use cases and deployment characteristics of gateway earth stations and terrestrial mobile stations, the two services can share this band and both make productive use of valuable spectrum under an appropriate regulatory regime. The wireless industry has made clear that “the primary opportunity for mmW deployment is in areas with the greatest population density . . . due to the fact that mmW spectrum is unlikely to deliver extensive coverage in a market but instead will be best suited to providing capacity via small cells and backhaul, particularly in densely populated areas.”<sup>11</sup> As the Commission has similarly recognized with respect to other spectrum above 24 GHz, short transmission paths and high propagation losses can facilitate spectrum reuse by limiting interference between transmitters and receivers in adjacent areas.<sup>12</sup> Indeed, the propagation losses will be even higher in the 47 GHz band than in the 28 GHz band due to the much smaller wavelength involved.

Accordingly, use of the 47 GHz band by UMFU systems will likely be concentrated in high-density urban areas, where small cell deployment is compatible with this spectrum’s attenuation limitations. Outside of those areas, there is much more space to accommodate FSS deployment that will be unlikely to affect 5G operations. Moreover, FSS gateway earth stations use high-gain antennas that direct emissions towards their target satellites, which significantly

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<sup>11</sup> See Letter from Scott K. Bergmann (CTIA) to Marlene H. Dortch, GN Docket No. 14-177 *et al.*, at 2 (May 20, 2016).

<sup>12</sup> See *Further Notice*, ¶ 6.

limits any potential interference toward terrestrial 5G deployments. As a result, there is only a small area around each earth station facility in which UMFU operations might experience interference – an area that is significantly smaller than that affected by earth station operations in the 28 GHz band due to greater signal attenuation at this higher frequency.

For these reasons, EchoStar proposes that the Commission adopt a sharing regime designed to capitalize on these factors as set forth in Exhibit A hereto. Specifically, UMFU licensees would be given priority in a limited number of urban core areas, where deployment of 5G services using this spectrum is most likely to occur. In areas outside of these urban cores, FSS and UMFU would be co-primary, and licensees would coordinate spectrum use on a first-come, first-served basis in much the same way that other co-primary satellite and terrestrial services in other bands do under existing Commission rules. This regime is similar to the one proposed jointly by EchoStar and AT&T for use in the 28 GHz band.<sup>13</sup>

As part of this regime, the operations of FSS earth stations would be subject to a PFD limit. In determining the appropriate PFD level for that purpose, we began with the “permitted interference zone” concept used by the Commission in adopting rules for the 28 GHz band. Under those rules, an individually-licensed FSS earth station that meets certain parameters designed to minimize its impact upon UMFU operations would be allowed to deploy on a first-come, first-served basis. The Commission defined this area around each earth station using a PFD of -77.6 dBm/m<sup>2</sup>/MHz.<sup>14</sup> That PFD level was based upon an analysis of potential

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<sup>13</sup> See Letter from Stacey G. Black and Jennifer A. Manner, GN Docket No. 14-177, *et al.* (Apr. 6, 2016) (laying out sharing framework, including definition of urban core areas); Letter from Stacey G. Black and Jennifer A. Manner, GN Docket No. 14-177, *et al.* (May 19, 2016) (providing detailed coordination guidelines). EchoStar does not propose that the Commission implement a safe harbor approach such as that previously proposed in these submissions.

<sup>14</sup> See *Further Notice*, ¶ 54. Under the rule, the PFD is to be measured at a height of 10 meters above ground level. *Id.* However, this same PFD limit applies at the boundary between two UMFU license areas, but is measured at a height of 1.5 meters, *id.* ¶ 312, which is more consistent with the height at which terrestrial

interference between FSS and UMFU operations in the 28 GHz band submitted jointly by AT&T, Nokia, Samsung, T-Mobile, and Verizon in the initial phase of this proceeding.<sup>15</sup>

Assuming that UMFU receivers will generally have the same performance at 47 GHz that they have at 28 GHz, this same methodology can be applied to the higher band to determine a PFD limit appropriate for the characteristics of that band.

Exhibit B attached hereto applies the methodology used in the Joint Ex Parte Letter to the characteristics of the 47 GHz band to derive a PFD limit of -72.8 dBm/m<sup>2</sup>/MHz. That limit is reflected in the sharing regime set forth in Exhibit A. Specifically, the area around an individually-licensed earth station subject to this PFD level may not (1) overlap with an urban core area; or (2) adversely affect the site at which an actual UMFU base station deployment is in operation or the initiation of UMFU site deployment (as defined below) has begun, unless otherwise agreed by the parties.

This regime is superior to the one adopted for the 28 GHz band for several reasons. First, it provides UMFU licensees with certainty that their operations in urban core areas – which are the most likely targets for intensive 5G deployment – will not be affected by FSS earth stations. Second, it establishes a co-primary sharing methodology that encourages both UMFU and FSS operators to make use of valuable spectrum as quickly as possible without imposing unneeded limitations on either service. Third, recognizing that satellite uplink sites are built into advanced broadband satellite designs but those earth stations will not begin operations during the several years it takes to construct and launch the satellite, this regime provides for long-range

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receivers are deployed. EchoStar intends to seek reconsideration in order to conform the height for both measurements at 1.5 meters.

<sup>15</sup> See Letter from Stacey Black, et al. to Marlene H. Dortch, GN Docket No. 14-177 and IB Docket No. 15-256, at 4 and n.8 (May 6, 2016) (“Joint Ex Parte Letter”). See also *Further Notice*, ¶ 310 (citing letter).

coordination. This will enable FSS operators to secure sites for uplink earth stations in the interim, providing the certainty required to support the investment of hundreds of millions of dollars required to design, construct, and launch an advanced broadband satellite. Fourth, clear rules will preclude any party from exercising a unilateral veto or acting as a gatekeeper to deployment in areas where it is not yet operating. This regime will allow FSS and UMFU licensees to share the 47 GHz band spectrum outside of the protected “urban core” areas fairly, and thereby enable both satellite and mobile services to make intensive and productive use of these valuable spectrum resources in a manner that does not unduly restrict the development of either service.

**B. The Commission Should Take a Bifurcated Approach to the 50 GHz Band That Reflects the Differing Allocations in the Band**

In both the domestic and international allocation tables, the 50 GHz band includes co-primary Fixed and Mobile allocations throughout the band. The lower portion of the band (50.4-51.4 GHz) also includes a co-primary FSS allocation, while the upper portion (51.4-52.4 GHz) does not. Accordingly, EchoStar urges the Commission to take a bifurcated approach to this band.

In the lower portion of the band, where FSS is co-primary, the Commission should adopt the same sharing regime discussed above with respect to the 47 GHz band. Because this higher wavelength has slightly different propagation characteristics, however, the PFD limit applicable in this portion of the band would be -72.31 dBm/m<sup>2</sup>/MHz as shown in Exhibit B. That limit is reflected in the sharing regime set forth in Exhibit A.

Although the upper portion of the band does not currently include an FSS allocation, that may change in the near future. The Commission is currently considering a petition for rulemaking filed by Boeing that proposes that the Commission add FSS Earth-to-space as a co-

primary allocation in the U.S. Table of Frequency Allocations and add this band to the list of authorized FSS Earth-to-space frequencies.<sup>16</sup> At an international level, the ITU-R is conducting studies pursuant to Resolution 162 (WRC-15) regarding the creation of a new co-primary allocation to the FSS in the 51.4-52.4 GHz band, including the assessment of potential effects on Fixed and Mobile services in the band.<sup>17</sup> As a result, WRC-19 could make the upper portion of the 50 GHz band available for FSS Earth-to-space use. EchoStar urges the Commission not to make any decisions with respect to this portion of the band while these matters are under active consideration. Doing so would pre-judge the appropriate use for this spectrum in ways that might not be consistent with the outcome of domestic and international processes. In these circumstances, the Commission should give those processes time to reach a conclusion before taking any action with respect to this portion of the band.

**C. The Commission Should Implement Its Rule Authorizing FSS Systems to Operate at ITU-Approved PFD Levels to Overcome Rain Fade in the 39 GHz Band**

Radio signals in the 37.5-40.0 GHz band are highly susceptible to “rain fade,” which occurs when water droplets in the air scatter or absorb a significant portion of the radio energy as a signal passes through the atmosphere. At these frequencies, rain fade causes substantial loss of satellite signal, which can be compensated by increasing the power of the transmitter. The Commission acknowledged in the *V-Band Second Report & Order* that rain fade would require

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<sup>16</sup> See Allocation and Authorization of Additional Spectrum for the Fixed-Satellite Service in the 50.4-51.4 GHz and 51.4-52.4 GHz Bands, RM 11773 (filed June 22, 2016).

<sup>17</sup> See Res. 162 (WRC-15), “Studies related to spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space),” available at [https://www.itu.int/dms\\_pub/itu-r/oth/0c/0a/R0C0A00000C0025PDFE.pdf](https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0025PDFE.pdf).

FSS operators to increase PFD above the normal clear-sky limits in order to meet system availability requirements and other satellite performance objectives.<sup>18</sup>

Accordingly, the Commission adopted a two-tiered PFD regime for the 39 GHz band. The first one prescribes limits that apply under free space conditions (*i.e.*, “when no allowance is made for propagation impairments such as rain-fade”).<sup>19</sup> The second prescribes limits 12 dB higher – *i.e.*, at the levels allowed under the ITU Radio Regulations<sup>20</sup> – and applies “during periods when [the] FSS system raises power to compensate for rain-fade conditions at the FSS Earth station.”<sup>21</sup> The Commission did not, however, specify the precise conditions under which it would permit such power increases, as that issue was still under study and would be the subject of a further rulemaking. It did advise, however, that “terrestrial licensees, when deploying stations in the 37.5-40.0 GHz band, should take into account the possibility of satellite operations for some limited period of time up to the maximum PFD contained in Section 25.208.”<sup>22</sup>

Because operating at higher power levels place additional demands on satellite systems, operators historically resort to such fade compensation techniques only when they are essential to maintain link availability. Thus, FSS systems operating in this band can be expected to transmit at the lower PFD level in the rules most of the time. Even when this is not the case, there is good reason to believe that operations at no more than the PFD limits specified in the

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<sup>18</sup> *V-Band Second Report & Order*, ¶ 29 (“We continue to recognize that rain fading has a significant impact on radio propagation at 40 GHz and that PFD increases and other ameliorating techniques will be necessary to maintain adequate satellite performance even to the limited extent provided for in the 37.5-40.0 GHz band.”).

<sup>19</sup> *See* 47 C.F.R. §§ 25.208(q)(1) (GSO systems), 25.208(r)(1) (NGSO systems).

<sup>20</sup> *See* ITU Radio Regs., Art. 21, Table 21-4.

<sup>21</sup> 47 C.F.R. §§ 25.208(q)(2) (GSO systems), 25.208(r)(2) (NGSO systems).

<sup>22</sup> *V-Band Second Report & Order*, ¶ 29.

ITU rules would not pose an interference threat to terrestrial systems in the band. Satellites operating in the 39 GHz band can be expected to use relatively small diameter spot beams in order to optimize frequency reuse. As a result, any increase in power could be localized to coverage areas that are actually experiencing a rain fade event. It is highly probable that terrestrial systems operating within that relatively small footprint would be suffering the same propagation conditions – and using techniques of their own to overcome these effects. Those measures would also help to offset any potential effect from increased satellite PFD levels.

In addition, other characteristics of UMFU deployment will likely attenuate any such effects. As the Commission observed in adopting rules for the 28 GHz band, “most industry evaluations of potential mmW mobile base station deployments appear to assume that such stations’ antennas will be tilted downward at a slight angle, typically from a street lamp pole or a location on a building at a similar height.”<sup>23</sup> The Commission also found that “it is important to recognize that most mmW transmissions will likely not occur in environments that have line of sight to satellites,” but instead will be found where signals are “heavily attenuated by exterior walls, roofs and windows.”<sup>24</sup> UMFU systems potentially subject to interference will be protected further by the path losses that signals encounter “in the cluttered environments of street canyons, suburban foliage, and other obstacles.”<sup>25</sup> Because terrestrial systems will be primarily pointed away from space and will be further shielded from space-based transmissions by buildings, trees, and other obstructions, any increase in satellite PFD would affect them only indirectly and to a limited extent.

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<sup>23</sup> *Further Notice*, ¶ 65.

<sup>24</sup> *Id.* ¶ 66.

<sup>25</sup> *Id.*

Clearly, the benefit of allowing increased PFD levels when necessary to offset rain fade conditions and maintain the integrity of satellite communications more than offsets whatever slight potential impact it might have on terrestrial operations. Moreover, the Commission could take additional steps to minimize the situations in which operations under the higher limits would be allowed. For example, in addition to specifying a much higher PFD limit for FSS operations in the 39 GHz band, Table 21-4 of the ITU Radio Regulations includes the following footnote:

When addressing the sharing conditions between the fixed service and the fixed-satellite service in the bands 37.5-40 GHz and 40.5-42.5 GHz, the power flux-density at the Earth's surface from any FSS satellite should be no greater than the level(s) required to meet the FSS link availability and performance objectives of the subject applications, taking into account the technical and operational requirements of the overall design of the satellite network. In any case, the levels shall not exceed the applicable power flux-density limits in Table 21-4.<sup>26</sup>

To the extent the Commission felt that terrestrial systems needed any further protection, it could incorporate this requirement into its rules for use of additional power to overcome rain fade.

The Commission has recognized that FSS systems operating in the 39 GHz band need to operate at higher PFD levels in order to maintain service quality during rain-fade conditions. It has already adopted a rule authorizing such operations. It is time the Commission took the final step by implementing that rule.

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<sup>26</sup> ITU Radio Regs., Art. 21, Table 21-4, Note 16 (No. 21.16.14).

## CONCLUSION

The spectrum above 24 GHz has great potential to support advanced broadband services, provided both terrestrially and via satellite. The proposals discussed above are designed to help unlock that potential for the benefit of U.S. customers. For the foregoing reasons, EchoStar requests that the Commission adopt those proposals.

Respectfully submitted,

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## **EXHIBIT A**

### **GSO COORDINATION GUIDELINES**

#### **47 GHz BAND AND LOWER 50 GHz BAND**

##### **UMFU LICENSEE ACCOMMODATION OF POST-AUCTION FSS DEPLOYMENT**

###### **General Rules:**

- Outside of urban cores, UMFU sites and FSS individually-licensed earth stations are co-primary.
- Consistent with the co-primary nature of these bands: (1) a party that has already begun operations shall be entitled to protection of its operational sites; and (2) where neither party has yet begun operations, the first of either the initiation of deployment of UMFU site in a given area or the filing of an application for an FSS individually-licensed earth station in a given area shall have protection against subsequent UMFU or FSS deployments.
- The area in which individually-licensed FSS earth stations in these bands generate a power flux-density, at 1.5 meters above ground level, of greater than or equal to -72.8 dBm/m<sup>2</sup>/MHz in the 47 GHz Band or -72.31 dBm/m<sup>2</sup>/MHz for the lower 50 GHz band, shall not (1) overlap with an urban core area; or (2) adversely affect the site at which an actual UMFU base station deployment is in operation or the initiation of UMFU site deployment (as defined below) has begun, unless otherwise agreed by the parties.

###### **Long Range Coordination:**

- A prospective applicant for an individually-licensed earth station in the 47.2-50.2 GHz band or the 50.4-51.4 GHz band may request from any UMFU license holder in the same frequency band that holds an area license for the geographic area in which the earth station is to be located or holds an area license for an immediately adjacent geographic area within 1 km of the proposed FSS earth station site information on the anticipated deployment of UMFU sites in those geographic areas over the next five years.
- Each UMFU licensee that receives such a request shall make this information available to the FSS party within 60 days. The UMFU licensee may require a non-disclosure agreement.
- Based on this information, the parties shall negotiate in good faith in an effort to coordinate a location for deployment of the individually-licensed FSS earth station.

- If the parties reach agreement on such a location, and the FSS party files an application for an individually-licensed earth station consistent with that agreement within five years, the earth station shall be deemed coordinated.

#### Standard Coordination:

- In the absence of Long Range Coordination, an applicant for operation of an individually-licensed FSS earth station in the 47.2-50.2 GHz band or the 50.4-51.4 GHz band shall, prior to the filing of its application with the FCC, send a coordination request directly, or via a third party or equivalent method, to all UMFU license holders in the same frequency band who hold an area license for the same geographic area in which the earth station is to be located or hold an area license for an immediately adjacent geographic area within 1 km of the proposed FSS earth station site.
- If the FSS earth station applicant does not move forward with its FCC application, it shall provide reasonable notice to the UMFU license holders and the coordination shall be deemed cancelled.
- This coordination request shall include the following technical data for the proposed earth station, for use in assessing the potential interference scenario:
  - Station coordinates
  - Frequencies and polarizations
  - Maximum effective isotropic radiated power
  - Emission designators
  - Antenna center line height(s) above ground level and ground elevation above mean sea level.
  - Antenna maximum EIRP towards the horizon
  - Antenna pattern
  - Antenna pointing angle in terms of azimuth and elevation
  - The coordination request will include a point of contact from the FSS operator.
- Each notified UMFU license holder will have up to 30 days to provide responses to the standard coordination request once all the technical data has been received. The UMFU license holder can request an extension of no more than 30 days, approval of which will not be unreasonably withheld.
- If a notified UMFU license holder does not respond within the response period, and the UMFU licensee has not received an approved extension of time, the proposed FSS earth station is deemed to be coordinated with that license holder.
- A notified UMFU operator can only raise a concern in response to a coordination notice if it has an actual deployment in operation that will be adversely affected or the initiation

of UMFU site deployment has begun that will be adversely affected. As used herein, “initiation of UMFU site deployment” has occurred where the UMFU licensee can demonstrate verifiable progress toward deployments, such as seeking appropriate zoning approval, purchasing or leasing land or tower space, or equipment procurement.

- This response should provide relevant technical information on the interference concern.
- If the concern relates to a planned deployment site (as opposed to an existing site), the UMFU licensee must provide the lat/long coordinates and the operational parameters of the planned deployment site.
- For actual UMFU sites and those where initiation of UMFU site deployment has begun, the parties will complete coordination within thirty days after the response to the coordination request (unless an extension is requested and approved). In performing coordination, the parties should first endeavor to minimize the impact to each proposed or actual operation.
- All technical problems that come to light during coordination must be resolved unless a statement is included with the FSS earth station application to the effect that the applicant is unable to resolve the conflict and briefly the reason therefore or the applicant chooses to deploy consistent with the Tier 1 safe harbor.
- The FCC, in acting on such a notice, shall take into account, *inter alia*, the impact on actual and potential UMFU customers, whether other solutions are technically and economically feasible, and the economic considerations for both parties.

## ADDENDUM

**Urban cores.** The table below defines those areas (“urban cores”) where FSS earth station deployment would be restricted. This urban core definition would be utilized for the area where UMFU licensees are primary and FSS licensees are secondary for use of the 47 GHz band (47.2-50.2 GHz) and lower 50 GHz band (50.4-51.4 GHz).

City	Longitude	Latitude	Radius (mi)
New York, NY	-73.868	40.85666	10
New York, NY	-73.8625	40.7035	10
New York, NY	-74.0161	40.65424	10
Los Angeles, CA	-118.489	34.13885	10
Los Angeles, CA	-118.208	34.11036	10
Los Angeles, CA	-118.307	33.97743	10
Los Angeles, CA	-118.185	33.835	10
Los Angeles, CA	-117.886	33.74954	10
Los Angeles, CA	-117.771	33.67137	10
Chicago, IL	-87.6852	41.91277	10
San Francisco, CA	-122.378	37.78215	10
San Francisco, CA	-122.24	37.63602	10
San Francisco, CA	-122.088	37.47337	10
San Francisco, CA	-121.926	37.32497	10
Baltimore, MD	-76.6189	39.2895	7
Washington, DC	-77.0362	38.90163	10
Philadelphia	-75.139	40.00419	7
Boston	-71.068	42.33205	7
Dallas	-96.7871	32.81516	7
Fort Worth	-97.3433	32.74955	7
Miami	-80.3003	25.76239	7
Houston	-95.4431	29.77929	10
Atlanta	-84.3888	33.79398	5
Detroit	-83.1101	42.3873	7
Cleveland	-81.6491	41.46988	5
Phoenix	-112.088	33.51522	7
Mesa	-111.757	33.41274	7
Seattle	-122.327	47.60569	7
Minneapolis	-93.3073	44.99572	5
San Diego	-117.129	32.79479	7
Portland	-122.652	45.50392	5
Denver	-104.974	39.75463	7
Sacramento	-121.437	38.56247	7
Las Vegas	-115.183	36.15023	7
San Antonio	-98.5322	29.4795	7
Jacksonville	-81.6355	30.29004	7
Kansas City	-94.5542	39.09859	7

Indianapolis	-86.1375	39.79521	7
Nashville	-86.7805	36.13374	5
Virginia Beach	-76.0976	36.825	7
Fresno	-119.788	36.77704	5
Austin	-97.7631	30.30681	7
New Orleans	-90.0656	29.97171	7
Columbus	-82.988	39.99866	5
Milwaukee	-87.9646	43.05331	5
Oklahoma City	-97.5282	35.46238	5
Charlotte	-80.8162	35.20615	7
Raleigh	-78.6422	35.82606	7
Louisville	-85.6922	38.19983	7
Tucson	-110.939	32.24249	7

## EXHIBIT B

### Power Flux-Density Calculation for 47 GHz and 50 GHz Bands

In order to calculate the PFD limit necessary to protect UMFU licensees in 47 GHz and 50 GHz bands, we assume the same 5G parameters and apply the same methodology as the calculation presented in the *ex-parte* filed jointly by AT&T, Nokia, Samsung, T-Mobile, and Verizon in the initial phase of this proceeding.<sup>1</sup>

The table below shows the calculation in detail with the 5G parameters from the Joint Ex Parte Letter:

	28 GHz	47 GHz	50 GHz
I/N margin [dB]	-6	-6	-6
Frequency [GHz] (Note 1)	28	48.7	51.5
Implementation margin [dB]	3	3	3
Receiver noise figure [dB]	5	5	5
Thermal noise density [dBm/Hz]	-174	-174	-174
Thermal noise density [dBm/MHz]	-114	-114	-114
5G receiver gain [dB]	16	16	16
Acceptable interference limit [dBm/MHz]	-128.00	-128.00	-128.00
gain of a square meter ( $4\pi/\lambda^2$ ) [dB]	50.39	55.20	55.69
<b>PFD limit [dBm/m<sup>2</sup>/MHz]</b>	-77.61	<b>-72.80</b>	<b>-72.31</b>

Note 1: For the calculations the center frequency of the 47 GHz and 50 GHz bands are used.

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<sup>1</sup> See Letter from Stacey Black, et al. to Marlene H. Dortch, GN Docket No. 14-177 and IB Docket No. 15-256, at 4 and n.8 (May 6, 2016) (“Joint Ex Parte Letter”).